DOCUMENT RESUME

ED 406 333 SP 037 208

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TITLE An Evaluation of Kolb's Learning Style Theory by Graduate Student Teachers during Their Teaching Practice.
PUB DATE Feb 97
NOTE 38p.; Paper presented at the Annual Meeting of the Association of Teacher Educators (Washington, DC, February 1997).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Action Research; *Cognitive Style; Foreign Countries; Higher Education; Learning Processes; Preservice Teacher Education; Secondary Education; *Student Teacher Attitudes; Student Teachers; Student Teaching; Teaching Methods; Teaching Styles; *Theory Practice Relationship
IDENTIFIERS Ireland; *Kolb (David A); *Learning Style Inventory (Kolb); Research Teaching Relationship; Teacher Researchers

ABSTRACT

This paper describes the reactions of graduate secondary school student teachers to an experiment which required them to evaluate specified techniques and theories of teaching and learning as part of their classroom practice. The aim of the experiment was to: (1) improve the quality of their judgments about pupils; (2) acquire variety in teaching styles; (3) increase understanding of student learning; and (4) evaluate the merits of Kolb's theory of learning and its application to teaching practice. Kolb's cycle of learning has four stages: learners are actively involved in a specific experience; they reflect on this experience from several perspectives; they draw conclusions using abstract conceptualization; and they take action as a result of the conclusions. Kolb developed a Learning Styles Inventory to determine the disposition of learners within a framework of four learning styles: convergers, divergers, assimilators, and accommodators. The student teachers devised lesson plans to take their pupils through each quadrant of the cycle and a test to assess student performance based on the learning styles. Over 50 percent of the participants said they experienced a permanent change in teaching as a result of the exercise; 56 percent said they fully intended to use the Kolb plan again; and 29 percent said they would use a Learning Styles Inventory in the future. Comments from student reports illustrate the insights which the exercise brought to the work of these student teachers. Six exhibits are attached. (Contains 17 references.) (ND)

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An Evaluation of Kolb's Learning Style Theory by Graduate Student Teachers during their Teaching Practice.

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Association of Teacher Educators Conference, Feb.,1997
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An Evaluation of Kolb's Learning Style Theory By Graduate Student Teachers During Their Teaching Practice.

1. Introduction.

The purpose of this paper is to describe the reactions of graduate student teachers to an experiment which they had to conduct during their teaching practice. These graduates were training to teach pupils in the age range 12 to 18 years in secondary schools in the subject in which they graduated in college. In the period 1985 to 1996 they were required for the assessment of a course in the Applied Psychology of Instruction to evaluate specified techniques and theories of teaching and learning as part of their classroom practice.

Normally they teach one of more groups of pupils (classes) throughout the school year. Their training which is of a years duration is divided equally between the university and school practice during the university terms on a weekly basis (i.e., two and a half days per institution). There is therefore potential for integrating theory with practice. The purpose of this particular course (about eighth of their contact time in college) was to provide for such integration in the area of instructional theory and practice. (see Heywood, 1996 for details).

The aim of this particular experiment (one of five or six depending on the year the course was taken) was to help graduate student teachers to

(a) improve the quality of the judgements they make about their pupils
(b) acquire variety in their teaching styles
(c) further their understanding of student learning, and
(d) evaluate the merits of Kolb's theory of learning and its application to teaching practice.

2. Kolb's Theory Of Learning.

The general proposition is that we have particular dispositions toward learning and our learning can be enhanced or impeded by the

The general proposition is that we have particular dispositions toward learning and our learning can be enhanced or impeded by the type of instruction we receive (teaching style). These dispositions have been variously called cognitive and now more commonly learning styles (Grasha, 1984; Schmeck, 1988). Some of them, and there are many (Grasha, 1984) may be strategies for learning rather than learning styles but that is another issue and is not for consideration here.

Kolb's experiential learning theory proposes that the cycle of learning begins with learners active involvement in a specific experience. It begins in the concrete. (see exhibit 1). The learner then reflects on this experience looking at it in a variety of different ways. From this experience conclusions are drawn in a cognitive process called abstract conceptualization. Thereafter the cycle is completed when the learner takes action as a result of these conclusions i.e., active experimentation. The y axis of the schematic (exhibit 1) is representative of inputs of information and the X axis of the processing of that information.

The styles are characterised as follows:

1. Convergers: Their dominant learning styles are abstract conceptualization and active experimentation. It is a mode of learning which has often been associated with classroom teaching and would be encouraged by traditional modes of assessment. People with this style do best in tests where the problems require single solutions. Not very emotional they tend to prefer things to people. Convergence relates to that part of problem solving which is involved in the selection of the solution and the evaluation of the consequences of that solution.

2. Divergers: These are the opposite of convergers. Divergers are best in situations of concrete experience and reflective observation. They like to 'imagine' and generate ideas. They are emotional and relate well to people. They do not perform well in tests which demand single solutions. Divergence relates to that part of problem solving which identifies differences and compares goals with reality.

3. Assimilators: They are concerned not so much with people but with abstract concepts. Their dominant learning styles are abstract conceptualization and reflective observation. They are interested in

the precise and logical development of theory than application. Kolb describes them as pure rather than applied scientists. Assimilation relates to the solution of problems and the consideration of alternative solutions.

4. Accomodators: are the opposite of assimilators. They like doing things and want to devise and implement experiments hence their dominant learning skills are concrete experience and active experimentation. Such individuals take more risks than those with the other learning styles. Accomodators excel in situations where they must adapt themselves to specific immediate circumstances. In problem solving accomodators relate to those parts solutions. of the process which choose goals and execute solutions.

Kolb developed a Learning Styles Inventory to determine the dispositions of learners within that framework. Scores are calculated for the x and y axes as shown in exhibit 2 and these locate the respondent in one of the four quadrants. Some may be on the borderline. For example, Kolb (1976) showed that among undergraduate majors nurses and engineers tended to be convergers, business students accomodators, english and political scientists divergers ,and economics and mathematics students assimilators. The focus of a discipline was found to be toward one of two specific poles that corresponded with the concrete-abstract and the reflective-active dimensions or as Biglan (1973) described them soft-hard and pure-applied.

It follows from this that any school teacher is likely to have disposition that is strongly related to the characteristic disposition of the subject he/she studied and that his/her teaching style may well be related to that disposition. For example a teacher of business is likely to be an accomodator and a teacher of english a diverger. It also follows that learners are likely to have preferences for both subjects and teaching methods which facilitate learning in their particular style. Thus it is argued that some learners may be disadvantaged if all the teaching they receive is in a style other than their own. Therefore there is need for variety in teaching.

Svinicki and Dixon(1987) have shown (exhibit 3) how different kinds of instructional activity can support the different phases of the learning cycle. They draw attention to the fact that there are activities in which the student is an actor and other activities where he/she is a recipient of information. These variables express

activities which demand involvement require a longer time for learning than reception learning but as I have pointed out elsewhere it is by no means clear that hurried "receiver" learning is conducive to understanding (Heywood, 1997).

Among the applications of the model is one by Fitzgibbon (1987)which conceptualized the supervision of teaching practice in terms of the Kolb model.

3. The Experiment

In an earlier experiment reported in 1991 (Fitzgibbon, Heywood and Cameron, 1991) we described how we had asked our graduate student teachers to familiarise themselves with Kolb's theory and other learning styles through lectures and the papers by Grasha(1984) and Svinicki and Dixon (1987). They were asked to devise a lesson plan which would take their pupils through each quadrant of the cycle and to devise a test which would assess whether the divergers in the class did best in the divergent part of the test, the assimilators in the assimilator part of the test and so forth. Having completed the lesson and test set about a week later we asked them with the aid of additional literature, in particular Grasha, 1990 and 1994, to discuss the question - Should learning styles be matched to teaching styles (taking into account their own learning styles)?

It was recommended that the model should be adapted so that new material related to the aims of the lesson was covered in each phase. This would enable the test items to be clearly related to each stage. In the theory, by contrast, a concept or priniciple would be taught in each of the styles and this would make it extremely difficult if not impossible to test differences in performance arising from the different methods of teaching. It was appreciated that in any event test design would be most difficult and this was taken into account in the assessment of the reports.

Given that the students were also required to review the literature and carry out two evaluations, one immediately after the lesson and one after the test, this was no mean exercise and resulted in very substantial reports two of which were published (Callaghan,1991; Carroll,1991). Schematic examples of some of the lesson plans which were submitted are shown in exhibit 4.

In addition to the reports many of students voluntarily completed questionnaires designed to elicit their opinions about certain dimensions of the exercise and simplify the analysis of the reports (Fitzgibbon, Heywood and Cameron, 1991).

4. Two Modifications.

subsequently two modifications were made to the exercise. These were

1. The students were asked on the basis of their experience of their pupils to that date to assign them learning styles on the basis of the Kolb descriptors. We hoped that by causing them to think about their students in this way they would obtain a better understanding of their learning capabilities within the context of their teaching. The test data would be related to these descriptions.

2. Because the six exercises represent a huge workload and sometimes created conflict with the demands of other subjects Fitzgibbon suggested that the independent exercise on imagery should be combined with the learning styles exercise. It was recommended that it should provide the concrete experience for the first stage. A few students used it to cover the whole cycle which was permissible.

Since 1995 a British equivalent to the Kolb due to Honey and Mumford was made available in the literature provided and one or two students based their report on this model.

In 1996 the opportunity was taken to administer a rating scale rather than a questionnaire (exhibit 5) The data obtained will be described with the exception of that related to the imagery exercise since that has been described in detail elsewhere (Heywood, 1996). Where there is a relationship with the data reported earlier this will be described.

5. The Sample and the Pupils.

Although the purpose of this diploma course is to provide the teaching qualification required by teachers in secondary schools some of these student teachers will obtain their teaching practice in State Co-ed comprehensive, community and vocational schools which admit the whole range of ability. In the past secondary

schools have tended to be selective but now their classes tend to be more mixed in the range of ability accepted and some of them have remedial classes. Whereas the State schools are co-ed secondary schools are on the whole single sex.

Post-primary (elementary) schooling begins at 12 years and ends at 18 years although some leave when legally permitted at 15 years. Public examinations which set the standards of the system are taken at the end of the third and sixth years. Most students are not allocated teaching practice in examination year classes. The majority will have classes in the first and second years. However, with the addition of a third year in the senior cycle many student teachers have been encouraged to take classes in the 4th year otherwise known as the transition year.

The subjects taught include Irish, Mathematics and English together with combinations from Business studies, French, German, Spanish, Geography,History, Mathematics, Music and Science in senior cycle, Biology, Chemistry and Physics). The numbers teaching these subjects varies from year to year; in any event the groups are relatively small since the total number of student teachers in each cohort is around a 100. Evidence from the reports suggests that there are no specific effects due to the subject per se although some topics within the subject may not be amenable to this treatment. Successful and unsuccessful outcomes have been reported in all subjects and this belies the view, sometimes expressed, that this or that experiment was not suitable for 'my subject.' Our 1991 report illustrated the complexity of the classes taught in terms of achievement levels and gender for which reason no attempt has been made to try and separate out these factors. Nevertheless the respondents taught in the range of schools and classes described above and this situation has not changed from year to year. They are therefore reasonably representative of the school system. Moreover there is considerable agreement between the comments in the reports from year to year as well as in the questionnaire responses for it to be possible to suggest one or two generalizations.

In 1996 107 students returned reports and 79 responded to the inventory. In our 1991 study (Fitzgibbon , Heywood and Cameron, 1991) we discussed 85 reports and 57 responses to questionnaires as well as data from the previous year. In the following I have referred to the 1991 group as the second sample. The 1996 group are identified by the item in the rating scale under discussion. The

The quotations from the reports are from other years mainly 1995 and are given in support of the contention that the comments and responses cover the same issues each year with varying insights.

6. Managing the exercise

It was expected that some students would approach the exercise with some apprehension. In so far as this exercise was concerned surprisingly few were apprehensive in the second sample. The imagery exercise caused much greater concern. In 1996 56% were apprehensive about the imagery (Item 28 exhibit 5). Whereas this question was not asked of the learning styles component 44% were surprised at how much they enjoyed the lesson (item 46) In all these activities there have been complaints about the length of time it takes to prepare let alone implement. 27% said it took too long (item 63). As has been said several times previously this factor needs to be taken into account when demands are being made on teachers to change their techniques. The hard work was not, however, without its rewards. For example

I felt that this was the toughest lesson to plan and test, and yet, it has probably given me the most interesting results and feedback of all the lesson plans, and it has given me an insight into the pupils themselves. It had not struck me that children who were disinterested in a topic may just be reacting to my teaching style. I think that if I were to do further evaluations on how certain methods will seem attractive to different students, then I might use this knowledge to re-structure my classes, and make them more appealing. The one drawback is the amount of preparatory work that would be required for each class, if you were to accommodate all styles (David Walsh, 1995)".

Linda Campbell wrote

" A huge amount of preparation time went into this lesson, however, the results of the exercise show that this effort was not wasted. I learnt that different students did better on different questions. This is not a new observation, in all tests we expect certain students to find some questions easy, and other students to find other questions easy. The results of this exercise however, have highlighted an explanation for this variation - students have different learning styles, and they will tend to do best on the question which corresponds to their learning style.
The results of this exercise helped me to see, who I had considered weaker students, in a new light. Prior to this lesson, I must admit I accepted weaker students as somewhat inevitable, and tended to attribute their lower level of success to lower intelligence and/or lack of effort. I learnt that their performance could be improved and was dependent on my teaching style. Of course there will always be weak and strong students, however there are teaching methods which can enhance their learning. Some of the weaker students whose learning seems to have been enhanced (the test scores are evidence for this) are Alan (55%), who was thought to be a converger, and indeed his

best questions were question 3 and 5 which are most suited to Convergers, Assimilators and Accommodators. Also, Kim (50%) who was thought to be a diverger, did indeed have her best result on question 1 which is designed to appeal to divergers and accommodators".

Fifty-one per cent said the the lesson was difficult to teach because of the pressure of time (item 61). A few student teachers, over the years, have taken two lessons to cover the cycle and science students have often been fortunate enough to have a double period. There is no reason why the exercise should not be completed over several lessons. Related to this is the question of entry into the cycle. These students were rather pressured into starting with the concrete stage. One or two have broken ranks and Cowan et al (1994) do not consider this to be a sin. . You can begin at the top as the majority of my students have done. Or you can begin at the bottom with a theory, test it out in one's own situation, apply it in everyday circumstances and reflect.

7... Scepticism

It was expected that some students would be sceptical about the exercise. This was born out in the comment made when the instructions were given. In response to the questionnaire twenty four percent of the second sample (N=14) said they were sceptical about the learning styles exercise before they began the class. Of them eleven reported their class to have been successful. One reported that it was unsuccessful. Nine said they would examine the learning styles of their pupils again. There was some suggestion that while this group of sceptics saw some advantages for the teacher in the exercise they saw little benefit for the pupils. In a similar sized group (N=67) who had done the same exercise in the previous year there was less scepticism and more enthusiasm (Fitzgibbon,Heywood and Cameron, 1991). Annular variations of this kind are to be expected. There will always be sceptics about different methods of instruction so where there is a demand for variety in teaching there is a need to understand the reason for this scepticism in more detail. One way might be to obtain personality data to see if there is some variable which relates to teaching styles that is deeply embedded (see Fitzgibbon,1994).

8. The effect of the learning style exercise on the teachers

Of the second sample 44% said that the exercise had demanded from them a considerable change in attitude toward their teaching. 54% said they experienced a permanent change in teaching as a result of the exercise. Unfortunately the questionnaire was not designed to yield what that might have been. Forty five percent said it caused them to change their role as a teacher and of these eighty two percent (22) said the pupils noticed a difference in their teaching approach.

Of those who reported that the exercise had caused them to change their role as a teacher the divergers reported least change. This suggests, that these particular student-teachers in keeping with their style, may tend in general to vary their teaching, a view which is supported by the comments they made in the evaluation sections of their reports. The convergers claim to have changed their role more than any other group, and this, like the respondents in our earliest work, was in the direction of greater interaction with pupils and variety in their classes. Exhibit 6 summarises these comments in respect of the second sample. The pattern of these responses suggests that the two styles theory indicates are most inclined to expository teaching (assimilator and converger) may benefit most from exploring instructional strategies favoured by the accommodator and diverger styles.

In response to the invitation to make general comments 29 (51%) in the second sample responded. The assimilators were less forthcoming than those with other styles. The divergers made the most negative comments which shows, perhaps, a dislike for the constraint imposed on them by the formal procedures of the activity. Similar results were found for the previous group. Forty-seven per cent considered that they had not looked at the pupils learning before or at their own teaching and learning styles (items 32 and 60). In their previous lessons 67% had used the style that suited them best (item 35) The lesson evidently caused many of the teachers to reflect on the relationship of their teaching to their pupils styles as these examples show

" Perhaps the greatest single lesson I will take from this assignment is that a class is not a single unit but rather a collection of individuals. The way that I learn best (assimilator/converger) is not necessarily going to be the way that each student in my class learns best"

I found that the pupils in this particular class tend to lean towards the active experimentation more than I had realized. I feel that this question (4) (in his test)

I found that the pupils in this particular class tend to lean towards the active experimentation more than I had realized. I feel that this question (4) (in his test) might have been the most difficult yet 50% of the pupils decided to answer. This indicates a strong experimental emphasis in this class that I had not recognized until recently".

" I have also found that my original comments on the entering characteristics for lesson plans 1&2 were perhaps facile and superficial. It is obvious that as the teacher/student relationship progresses it is bound to become more complex and have greater depth. However I have learned not to put too much emphasis on labels and to be aware that a pupil may not only grow but that initial judgements may be incorrect. I feel a teacher needs to be flexible when considering one's students and to understand that it is sometimes one's perceptions that need to be altered (John Davis, 1995)".

"From the experience of this lesson plan it has become clear to me that the learning styles of my pupils are very varied and that each of them require different teaching methods. I have now found that my students enjoy learning in different ways and that they benefit from the style that suits them. I had a fairly good idea of the learning styles of each student but now I am more certain and as a teacher, I can try and meet their classroom needs and demands". In a science class it is noticeable that pupils prefer different activities some like discussion, some problem solving and others experiments. But up until now I was not fully aware that these preferred activities relate directly to the pupils learning styles. Since this research I have learned that I need to look closely at my teaching methods for all classes and try to match teaching styles with learning styles (Lorna Prendergast, 1995; Science)".

I can say without hesitation that I enjoyed currently both the lessons. As I had so much I wanted to fit into two lessons the classes needed good timing. The fast pace and changing activities got the children and myself very stimulated"

" I am myself a diverger and did not realise until recently how much how much I taught in this style. This may be also explain why I put a majority of my students in the diverging category perhaps I am assuming too much". (Orlaith Gallagher, 1995, History).

And another diverger wrote:

"Now I see that this is probably the result of a conflict between my favoured teaching style and their learning style. For example. I could never understand pupils who were not inclined to share their ideas , or who were more interested in ideas and concepts than in culture and people. One of my least favourite questions in class is one of the accommodators favourites - what use is all this? - and I realise now that this is because as a Diverger I am not too concerned with practicality". (Anita Wilson, 1995: French; 15-16 year olds)

Oddly enough 31% claimed their normal approach was pupil centred and 31% said their normal style of teaching was expository (items 54 and 55). So was the experiment successful in terms of the goals it set out to obtain? These goals were to evaluate the potential of

Kolb's learning theory in classroom practice and to see if it helped them get better judgement of their students having had to assign styles without the benefit of an inventory, and not surprisingly half of them found this to be a difficult task (item 57). This suggests that some of their earlier judgements may have been superficial.
Several students shared the work with their students and asked the students to assign themselves. The reports always showed that the teachers assured their students that these were not rigid categories others did not tell their students their styles because they did not want them branded. First an example from Mary Greene (1995) on the assignment of styles:

" Clare: She is very good at making decisions and being practical about how to apply ideas. When she is working, she likes to organise her notes and apply herself to finding the answer. She feels uncomfortable talking about feelings and emotions and is really happier dealing with tasks than people.
Deirdre: She is very imaginative and loves doing and experiencing things. Deirdre is happy watching and reflecting on problems because she enjoys working out alternative answers. She is very interested in people and is in touch with her feelings. (Diverger)
Amy: Amy likes observing and thinking about ideas but she has to work in a logical way and is very precise. She really enjoys bringing in different information into her projects but is more comfortable with ideas than with people. (Assimilator)
Annabel: She is the opposite to Amy and loves doing and experimenting and new experiences. She is very adaptable and intuitive and good at working by trial and error. (Accommodator).

and Catherine McAndrew (1995) who found she was involving her students in the activity.

"I explained my own learning style (assimilator) to the students. I told them that my preferred style of learning was by watching and thinking, that is, I grasp an experience by comprehension and transform it into knowledge by watching (reflection) rather than by doing. I informed them all people differ in their way of thinking and learning. I gave the students some examples i.e some like to deal with concrete things and actively work with them whereas some like to reflect on the concrete experience rather than apply it to some new experiences. I then gave the students the terms of the different types of knowledge by watching reflection rather than apply it to some new experience. I then gave the students the terms of the different types of knowledge that result from our different ways of learning. I listed the names Accommodator, Diverger, Converger, and Assimilator on the blackboard. The students immediately, wanted to pick their own style of learning there and then. I thought this was a good idea and let them pick the one that they felt they were and I promised them at the end of the project we should have a better idea if they were right or wrong. They thought this was great fun and were instantly motivated and wanted to get started right away"

Marie Raftery (1995) wrote.

Had I never carried out this lesson plan I do not think that I would ever have analysed my own teaching style in such depth. I am now aware that I do tend to teach in a way that

be having on other students - motivating them and allowing them learn in their own way".

Fifty-nine per cent of the 1996 sample said the exercise helped them improve their judgements. Unfortunately a mistake in editing left a similar item in (Items 56 and 58) and contradictory evidence was produced. Nevertheless, the lower response to the second item is still relatively large. In 1995 90% (N=91) reported they had learnt more about their students as a result of the exercise.In 1996 eighty-five per cent said they learnt that a teacher must accommodate all styles (item 34) and 61% said they learnt about the importance of learning styles (item 36). 70% said they learnt that there could be a difference between teaching style and pupil learning style (item 39). 28% said they learnt that the variety of teaching they were offering was limited (item 47) while 54% learnt more about the way they teach (item 51). Other responses to items in the inventory suggest that the exercise irrespective of any correlations shows that many student-teachers benefited overall.

9. Pupil Perceptions and Responses

The above data serves to support the view that planning lessons in the phases of the Kolb cycle results in noticeable changes in teacher behaviour on the part of the consumer. It is interesting to note however that there is an inverse relationship between age as measured by class (grade) year and teacher belief about pupil perception of changes in their approach to teaching. Whereas the majority of the older students (14+years) were not reported as having observed changes, the majority of the younger children did. However there appears to be an element in this perception which is a function of the perceived achievement level of the class. Those classes which were said to be high achievers were more often considered by the student-teachers to be aware of differences in their teaching approach. Because a large number of the student-teachers told their pupils they were participating in a research experiment the data above has been examined for a possible halo effect. The evidence in the reports suggests that the effect, if any, of telling students about the experiment might not have been as important as the novelty of the experiment itself. Thus 78% of the 1996 sample reported that students like to be presented with new ways of learning (item 1) and that they like a variety of teaching methods (item 8). Pupils monotony is overcome by changing teaching styles. Perhaps this is a reflection of the 'instant' age in which we

live and that some student-teachers found this to be important is significant.

10. Student-Teacher Perceptions of their Pupils

The student-teacher whose remarks on the inventory began this discussion had this to say about the distribution of learning styles in her class.

"the predominance of accommodators in the class has led me to reflect that it is age-related. Many of these students (12-13 years) may just be coming out of the period of concrete operations and it is normal that they would have as first preference for the "action" oriented option". "Is', this , " measure of L.S. valid before their personalities have developed more fully? Will these accommodators change style as they develop?"

Several others made the point that if students were at the stage of concrete operations any attempt to determine style would be swamped. However, Miriam Crowley (1992) had never realised the value of concrete experience before. When teaching about the neolithic age she asked

"Why only one person was buried in a cyst when very often up to 40 people were buried in some of the neolithic burial monuments. At this point I realised just how beneficial concrete experience was for the student. The student had never seen any type of neolithic burial structure (except in photographs) therefore she was unable to comprehend just how large these structures are. On the other hand although the model of the cyst was a scaled down version of the real thing the student could see how the skeleton fitted neatly into the coffin shaped structure. Therefore a real stone cyst would be only slightly larger than the average coffin".

Some component of spatial ability seems to have been tapped. Related to this is the notion of activity in learning (active experimentation). Rosemary O'Regan (1995) writing about a maths class said

"The results (of her test) give a good estimate but I would not take them at face value. The lesson content that was the easiest was the third lesson, dealing with trees and diameters and this skewed the results. The real test I feel was their reaction in class. On the whole the two major ideas I can take out of this class are that they are not in tune with reflective observation and are much more capable at active experimentation. I have found in the past that the students prefer being active and doing things for themselves to watching what I present them with. Fear sets in if I ask someone why they think something happens without explaining to them first. A lot of them have problems with expressing what they know. One day in pair-work two girls had fallen out over a method to solve a problem and they decided to go their separate ways. When I came to correct the work, both of them had tackled the exercise correctly. I concluded from this that they can do exercises but they are not confident in communicating how to do them to others. Looking at the learning styles of the two students I can see why this might have happened, Lena's learning style is type 1, concrete experience/reflective observation whereas Tanya's is type 3, abstract conceptualisation/active experimentation. I think this proves

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that teaching should match learning styles. As everyone internalises things in a different way, it can be difficult for one person to communicate effectively to another their perception if their thinking styles don't converge".

These remarks raise questions about the concreteness of dispositions during adolescence as well as providing an important insight into problems of communicating with others.

Fitzgibbon, Heywood and Cameron (1991) found from analysis of the early (second sample) reports that 58% of first year pupils were accommodators compared with 49%, 47% and 42% respectively for assimilators, convergers and divergers. This can be contrasted with 19%, 37%, 38% and 33% for those in classes higher than second-year. It would seem that there is also a gender difference with younger boys and older girls being proportionally more in the accommodator group. But the investigators did not check student teacher scoring and there would need to be a formal experiment with a more appropriate inventory to examine the development of styles with age (Fitzgibbon, Heywood and Cameron, 1991 , see also comment on the inventory below)

Also related to this is the press on the learning environment to which the students become accustomed. To what extent does it condition learning styles? The student-teachers reported, and it was the experience of the investigators that teaching in second-level education in Ireland tends to be expository because of beliefs about the requirements of the public examinations taken at the end of the third and sixth years of the cycle (i.e at 15+ and 16+; Heywood, McGuiness and Murphy, 1980). Teachers believe that there is only one way to cover the syllabus and children adapt their learning to the recall of information suitable for the examination. The teachers "accommodate' to this need for surface learning for these examinations, and this may be reflected in their teaching styles. Pupils respond in kind. For example Shirley Keilaway (1992) wrote:

"While they are an extremely imaginative group and capable of making impressive forays into abstract thought relative to their age, they are also very 'traditional' in my opinion in what they perceive as pupil role and teacher role. They have great potential for creativity but they are not independent learners. Everything must be ratified by me as teacher for it to have any value in their eyes ....."

The investigators argued that the limited types of instruction used in schools led the pupils to enjoy the classes which were devised to meet the Kolb cycle because whether in a single lesson or over several lessons, as was sometimes the case, the student-teachers

reported, with only three exceptions, that their pupils enjoyed the learning cycle lessons. It seems that more might be done if teachers did not underrate the abilities of their students. Thus 32% in the 1996 sample said they underestimated their students abilities. 23% underestimated their pupils enthusiasm for discussion (items 9&10) and 71% learnt that pupils monotony is overcome by varying their learning styles (item 17).

11. The Second Groups Attitudes to the Inventory.

Although the 1996 sample did not use the learning styles inventory the 1991 group did. Their attitudes toward it are of some interest.

Grasha (1990) who is a specialist in learning style inventories having developed one himself came to question the reliability and validity of these inventories and the failure of their authors to identify clear instructional procedures that would enhance certain styles. He also noted the comments of a minority of participants who said I cannot relate to these categories. They do not describe people I know. He would have sympathised with the student teachers in these samples because they brought up all the same issues. Moreover, they were being asked to implement an inventory normally used with adults. It is not surprising, therefore, to find that a number of them reported that younger students had difficulty in understanding the words of the inventory, and one reported that a group of fifteen to sixteen year olds had also had such difficulty. Another student teacher reported that she had administered the questionnaire to her first year (12-13 year olds) class one month before doing the lesson. She found that some of the words used were so "incomprehensible" that the pupils had to rely on her interpretations.

" I also feel that in answering the questions, people (children and adults) tend to choose the answer which corresponds to how they would like to see themselves as opposed to how they really are. I am still not sure to what extent I personally was guilty of this tendency in my own answers when I did the inventory at the beginning of the course.".

Because of these doubts this student teacher not only questioned the validity of the questionnaire but decided to administer it again. Of the 21 students who answered the questionnaire on both occasions 7 (i.e. one third) changed learning styles between the first and second tests. Inspection of the results suggests that there was a general

movement toward the centre of the axes which was not accounted for in her comments..

When she came to evaluate her work she concluded that although there was no evidence to support the view that students learn best in the phase which corresponds to their own learning styles, teaching a lesson which passes through the Kolb cycle improves learning.

However, many students did not comment on the language of the inventory. Despite many reservations about the validity and reliability of the inventory these student teachers felt the exercise was useful. Of the sample, as a whole, 84% would examine the learning styles of their pupils again, 63% would in future teach their children about their learning styles and 77% thought pupils needed training in learning styles.

This approach illustrates the use of the inventories as "operators" regardless of what they actually measure. Further we have found it to be a useful tool for framing discussion. The limited evidence suggests that the classroom methods adopted by the student-teachers may be limited by their own needs and preference. This limitation has been reinforced by their previous experience of education at school and university which emphasises content regurgitation at the expense of conceptualization, understanding and application. This view is supported by the extensive information given in their educational autobiographies, journals, and the reports of their other investigations.

12. 1995 and 1996 - Overall Attitudes.

In 1996 56% said they fully intended to use the Kolb plan again and 29% said they would use a learning style inventory in the future (items 62, 69) in spite of knowledge of the previous work by other students in previous years. Some comments in the 1995 reports illustrate the insights which the exercise brought to the work of these student teachers and bring this paper to a close.

In future to determine students learning styles I would ask the students to write a self report, as Sternberg suggests, specifically in relation to geography. I would make it known to the students that what they would write would be treated with the utmost confidentiality, and that its intention was to help students in their learning and they should therefore take it seriously (and admit, for example, the extent to which they are

competitive). I would also take students performance into account (as I did in this exercise) as this is the sole evidence of the areas which a student found easiest to learn. In addition I would use a learning style inventory such as David Kolb's. The questionnaire might identify some additional credentials. I would also take into account my observations of the students and the types of instructional and assessment activities which a student prefers. In summary, therefore, I would use a variety of instruments to assess students learning styles as the more information that can be gathered on each student the more likely the teacher will be correct in assessing the students learning styles (Linda Campbell, 1995- Geography)

In future in the early part of the year I would like to teach a lesson like the one I have just completed and test it similarly to determine pupils learning styles. I would take account of pupils reactions to the different phases of the lesson (which I found conclusive in this case) as well as of their performance in the test. I feel that it would be useful to note pupils favoured learning styles as early as possible in the year so that I could adjust my subsequent lesson plans accordingly. Just before I leave learning styles it has occurred to me that the examination process should be adjusted to take the different styles into account so that teachers would feel free to use all styles with confidence and without the threat of being charged with filling his/her class with irrelevance (Anita Wilson, 1995)

And Una Murray (1995) who wrote

"In evaluation 1. I discussed my reactions to the whole lesson. One of the main things was that I found the development into the various stages of the Kolb cycle fairly natural. On analysis of my own style - I am an assimilator converger. I realise that I always try to ground material in their own experience to different extents and in doing so I have frequently used imagery. The only time I felt that the class was a little different was during the active experimentation stage. When this is taken into consideration with the increased results of the accommodators, this suggests that I do not devote enough time in the normal lesson to this type of learner. On the other hand, the consistent high achievers who seem to be assimilators or convergers have suffered. Does this mean that my former classes have been focussed towards their style - as I have that type of teaching style and therefore when teaching time is distributed among the four learning styles they are the ones to suffer? Should a class then be divided up according to learning styles to maximise potential? Should teaching styles match learning styles? My results seem to suggest this".
Sternberg's article addresses these problems. I have fallen into the trap of what Sternberg refers to as believing that "They've gotten smarter! This is of course not true. but it does confirm Sternberg's point that variety is very important for the teacher otherwise lack of ability may be confused with mismatch of learning styles. This is what happened in my case to a certain extent. Therefore as to whether teaching styles should be matched to learning styles the answer is to a certain extent yes. My students who match my teaching style certainly seem to benefit from it but the rest of the class do not. Yet variety is the key. Sole attention to one learning style may reduce the dynamic nature of the human being (Grasha 1994). Grasha and Sternberg also alert us to the fact that learning styles may change. Learning a variety of styles may solve the problem for the students but some people are just not suited to a certain learning style and imposing a style may have adverse consequences with regard to motivation and interests" (Una Murray, 1995).

13. Alternative approaches to obtaining information about Learning Styles

Grasha (1990) came to the conclusion that other methods might be more revealing and identified four. These were direct observation, in-depth interviews, analysis of self-directed learning projects and the analysis of the guiding metaphors students used when describing the teaching learning process. In respect of the first he was struck by a study of classroom interactions by Mann et al (1970) from which a typology was derived. It was built around these three main categories.

1. Capability of students to handle course demands. Capability determined by students.
2. Need for teachers to directly control classroom tasks. Control maintained by the instructor.
3. Willingness of teachers to build and maintain relationships

Teachers will be familiar with the types listed. Grasha noticed three kinds of students. They were (1) those who had a need for structure and dependency (2) those of independent orientation or need to be away from the influence of others and (3) those who needed to have the attention of others. It seems evident that there are general orientations around which instruction and content can be constructed.

By and large school teachers would not have time to carry out in-depth interviews with their students to determine all their learning styles. However, they do have to undertake in-depth interviews from time to time and the ability to extract the approaches their students have to learning is an invaluable skill. These learning style models give them a typology against which they can construct a framework for analysis.

The exercises described above have with one or two minor changes been repeated by between 80 and 100 student-teachers in each year of a 7 year period. All were characterised by lesson plans and tests designed to meet the requirements of the Kolb teaching theory. The teachers were able, sometimes with difficulty to relate their teaching approach to one or other of the styles described by Kolb. Whether or not these are deeply held dispositions or orientations toward certain strategies is a matter of conjecture. The proposition that pupil orientations are influenced strongly by the type of teaching they receive needs to be investigated. If they are styles

then does their prior education reinforce some styles at the expense of others. Also, are styles influenced by stage of development?. With little difficulty most of teachers were able to accommodate the alternative approaches to teaching required by the other three quadrants of the Kolb cycle.

The combination of the lesson and test led these student teachers to believe that the students responded differently to the different methods. As a result many came to the belief that at times they were disenfranchising some of their students. Thus most were led to the view that variety of method was a *sine qua non.* Notwithstanding the instability of the Learning Styles Inventory those students who used it found it a useful indicator of differences even though they were suspicious of its validity and reliability with young adolescents. They did not question the theory. When asked to describe students in terms of the Kolb styles while finding it difficult they were prepared to do the same thing again, and a number of useful methods were suggested. Many of them found the process gave them great insights into their pupils and there are countless examples of how the exercise had helped them with their teaching.

The least that can be said is that it would seem students may be described in terms of these styles because although the examination system presses the students to learn and the teachers to teach in a particular way it does not not swamp the basic style teachers observe. Therefore a knowledge of style is of considerable value to students.

Most of the school students were in the age range 12-15. There were also successes and failures with post 15 year students. Classes might be more successful if they have exposure to learning styles teaching in the junior secondary school. No consideration was given to the idea of a course based on learning styles although most of the student teachers would not envisage themselves teaching in this way all the time. It has been demonstrated, not withstanding any novelty effect, that lessons of this kind motivate students and given early in a course can provide teachers with valuable information about their students as well as motivating the students themselves.

14. Discussion

Grasha's experience is that teachers in higher education have found it very difficult to change from one style to another and this is supported by the findings on the effects of experience on learning (see chapter 13). In particular it may be supported by the student teachers whose experience gives rise to certain expectations from which they are unwilling to change. It is for this reason that in pre-service training students need to practise changing their roles and help their students to respond accordingly. These exercises with the Kolb model which the students undertook made a very modest beginning to tackle this problem. Perhaps the most important thing is that it is not merely a matter for the teacher but for the students as well. As these studies show both are likely to benefit. However , in a system which is governed by public examinations and where peer group pressures to teach in particular ways are strong to the extent that teaching of this kind is perceived to be irrelevant (see Anita Wilson above) teaching of this kind needs to be supported by a whole school policy. In so far as training is concerned one go is totally inadequate for either the students or the teacher other than that it can alert teachers and their students to the problem a point affirmed by Cowan et al (1994).

Acknowledgements.

I am grateful to all the students who participated in the exercise and especially to those who allowed me to quote from their reports. I am also grateful to Ms Ann Fitzgibbon who made the original suggestion for this exercise as well as the imagery adaptation.

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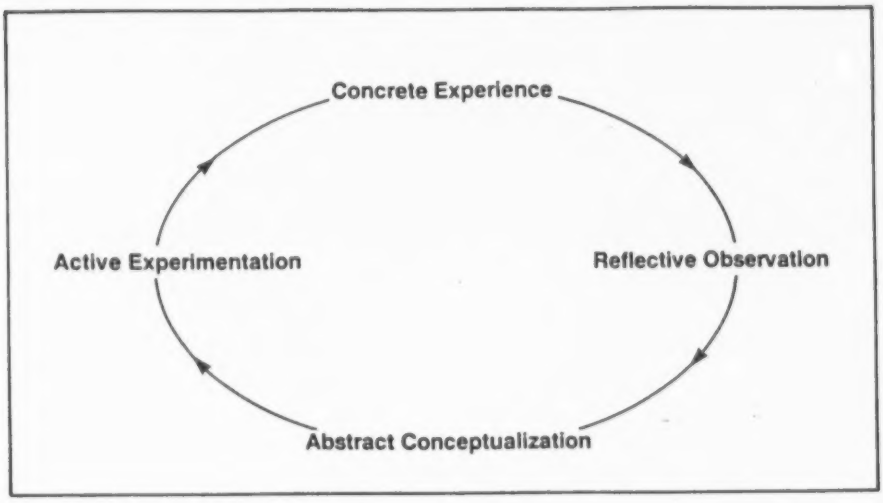
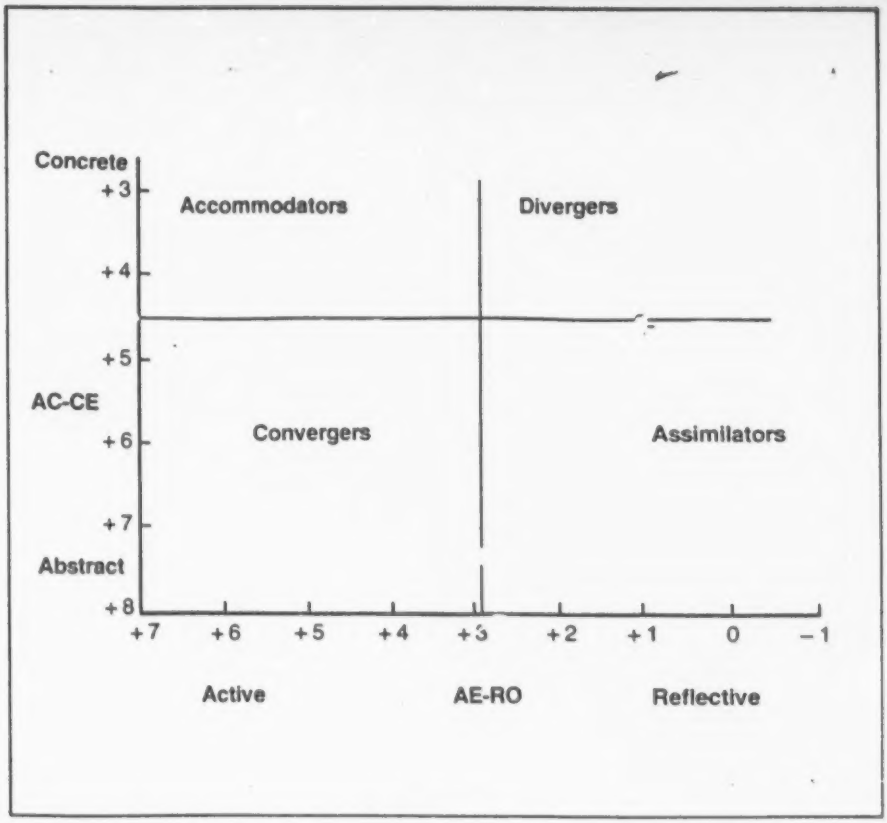


Exhibit 1. The Kolb Cycle of Experiential Learning. Concrete experience relates to "feeling", reflective observation to "watching", abstract conceptualization to "thinking" and, active experimentation to "doing."



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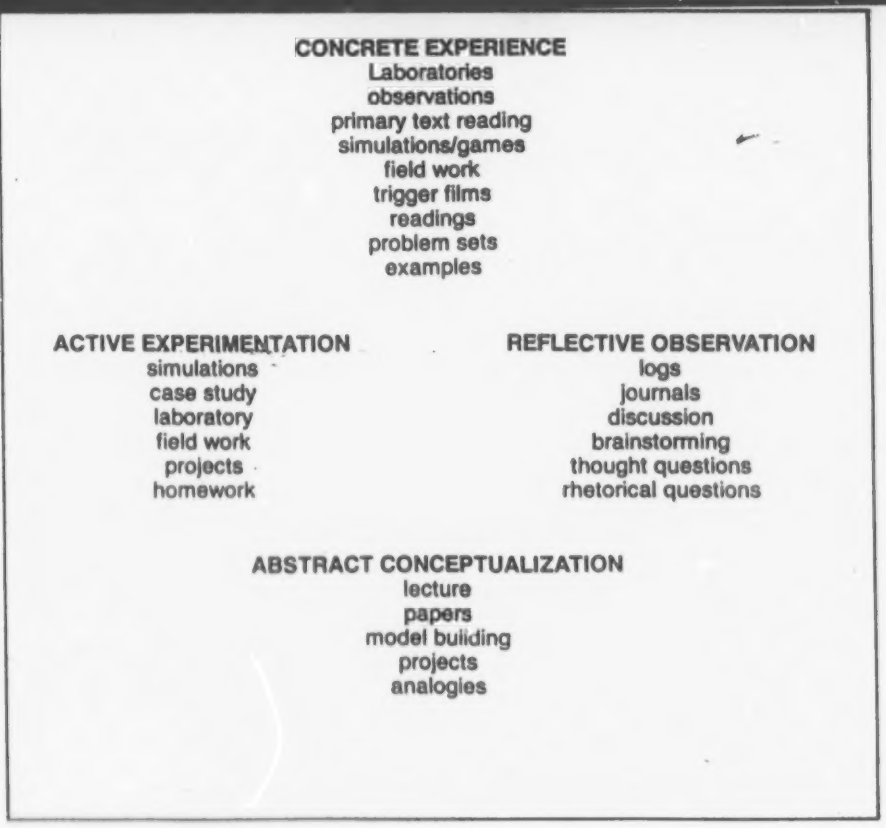
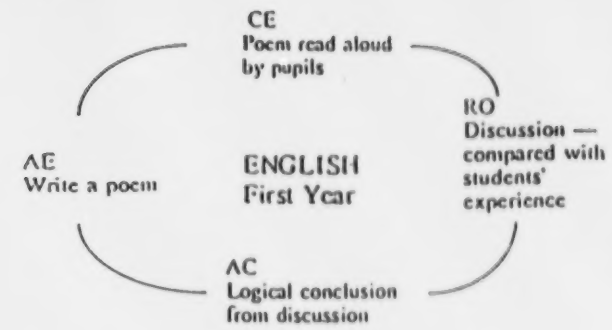
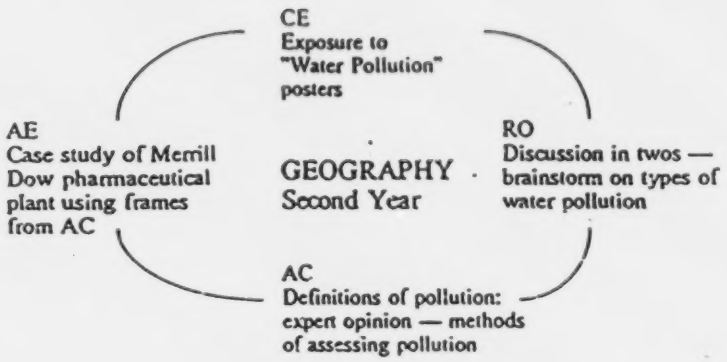


Exhibit 3. Instructional methods associated with the learning styles suggested by Svnicki and Dixon (1987). Reception learning is at the centre. As the learning changes in the direction of the periphery so it becomes more experiential and the learner becomes an actor.

Poem appreciation



Water Pollution


CE
Exposure to "Water Pollution" posters
AE
Case study of Merrill Dow pharmaceutical plant using frames from AC
GEOGRAPHY
Second Year
RO
Discussion in twos — brainstorm on types of water pollution
AC
Definitions of pollution: expert opinion — methods of assessing pollution

Rituals of Spain

Exhibit 4. Some schematic examples of lessons given by the graduate student teachers whose work is described in the text.

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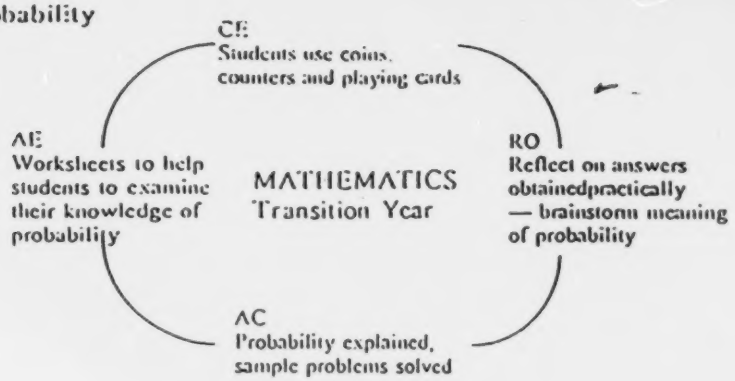
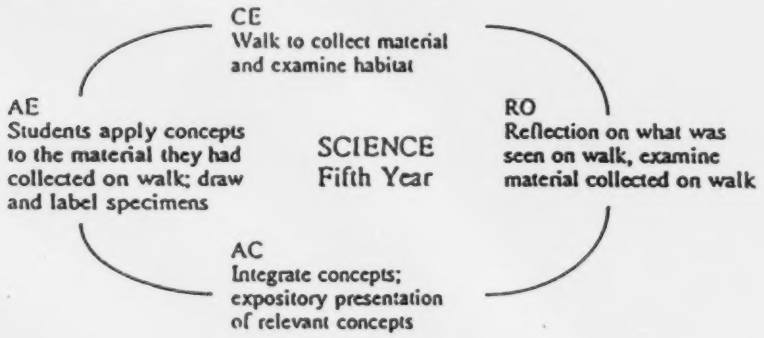
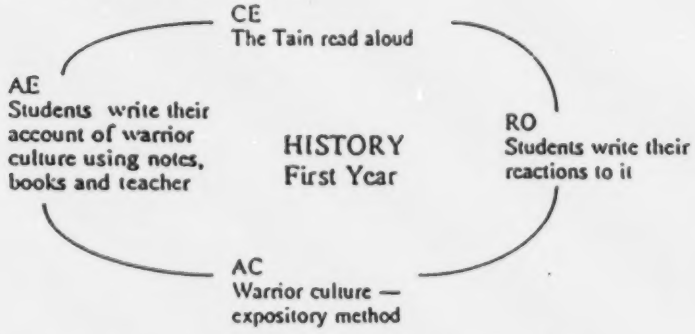
Probability



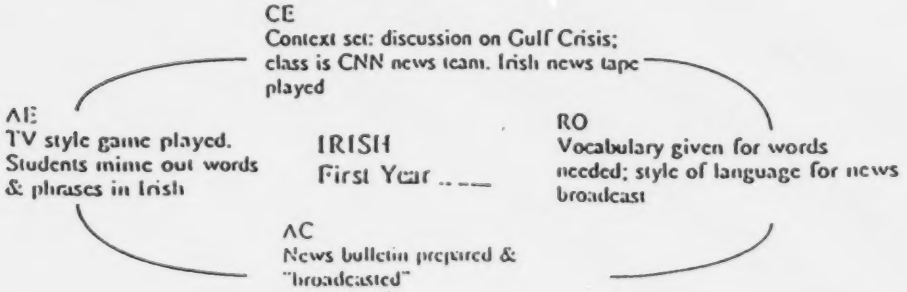
External Structure of Dicotyledonous Plant


CE
Walk to collect material and examine habitat
AE
Students apply concepts to the material they had collected on walk; draw and label specimens
SCIENCE
Fifth Year
RO
Reflection on what was seen on walk, examine material collected on walk
AC
Integrate concepts; expository presentation of relevant concepts

Warrior Culture of the Celts



Vocabulary for use in a Current Event (Gulf Crisis)


CE
Context set: discussion on Gulf Crisis; class is CNN news team. Irish news tape played
AE
TV style game played. Students mime out words & phrases in Irish
IRISH
First Year
RO
Vocabulary given for words needed; style of language for news broadcast
AC
News bulletin prepared & "broadcasted"

EVALUATION OF LESSON PLAN 4 / 5 IMAGERY AND LEARNING STYLES

Name: .....

Subject taught: .....Class taught:.....
Please indicate which of the following statements relate to your experience of the imagery and learning styles exercise. Please answer as quickly as possible. Each of the statements has been taken from comments in Evaluation 3 of your reports.

ABOUT YOUR PUPILS :	No.	%	Item
I learnt that: students like to be present with new ways of learning	62	78.48	1
. . pupils enjoy tasks in which they have to give their own individual responses	50	63.29	2
. . my pupils were capable of more than I thought	31	39.25	3
. . my pupils were willing to experiment with new ideas	44	55.69	4
. . not all my pupils enjoyed the experience of imagery	50	63.29	5
. . my pupils like variety of teaching methods	62	78.48	6
. . not all of my pupils learn like me	61	77.2	7
. . my pupils like novelty in teaching	60	75.94	8
. . I underestimated my pupils enthusiasm for discussion	18	22.78	9
. . I underestimated my pupils abilities	25	31.64	10
. . I felt important to my pupils	21	26.58	11
. . the students I had difficulty taming seemed to be of a particular learning style	26	32.91	12
. . that the imagery exercise could show how rich the pupils imagination could be	44	55.69	13
. . imagery seemed to increase their concentration	42.	53.16	14
. . imagery seemed to increase their motivation	70	88.60	15
. . my pupils were flexible, open-minded and eager to achieve	33.	41.77	16
. . pupils monotony is overcome by varying teaching styles	56	70.88	17
. . imagery can relax and improve the behaviour of pupils	47	59.49	18
. . some students were more interested in some stages than others	62	78.48	19
. . the quantity of quality of the written responses improved as a result of imagery	32	40.5	20
. . high achievers had difficulty in adapting to other styles of learning	15	18.98	21
. . it is not sufficient to assume a students capability	55	69.62	22
. . pupils can succeed in teaching styles they do not necessarily like	40	50.63	23
I got to know a different side of my pupils	40	50.63	24
I underestimated the ability of the pupils to cope with imagery	34	43.03	25
The test I gave showed a substantial all round improvement in performance	31	39.25	26
ABOUT MYSELF :			
I had not considered using imagery before	47	59.49	27
I was apprehensive about delivering the imagery exercise	44	55.69	28
I found it difficult to design an imagery exercise	27	34.17	29
I had used imagery with this class before	18	22.78	30
I found it somewhat difficult to switch to different styles	25	31.64	31
I don't think I looked at the pupils learning before or at my own teaching and learning style	37	46.83	32
I found the class went well because of the different teaching styles	53	67.08	33
I LEARNT THAT :			
. . a teacher must accommodate all learning styles	67	84.8	34
. . in my previous lessons I was using the style that suited me best	53	67.08	35
. . about the importance of learning styles	48	60.75	36
. . my view that it is good to teach with a variety of styles was reinforced	42	53.16	37
. . a teacher must accommodate all learning styles	47	59,49	38
. . there can be a mismatch between teaching style and pupils learning style	55	69.62	39
. . I became more flexible as a teacher	50	63.29	40
. . more about myself as a teacher	45	56.96	41
. . I seemed high motivated by the novelty of the exercise	28	35.44	42
. . imagery changed the way I regarded students	23	29.11	43

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. . imagery is a realistic and productive teaching style	43	54.43	44
. . a teacher must accommodate all learning styles	43	54.43	45
. . to my surprise I enjoyed teaching the lesson	35.	44.30	46
. . the variety of teaching I was offering was limited	22	27.84	47
. . teaching styles can effect pupil performance	54	68.35	48
. . question design in the test can influence pupil performance	45	59.96	49
. . imagery is a valuable teaching technique	49	62.02	50
. . more about the way I teach	43	54.43	51
. . to vary style to catch the needs of students	47	59.49	52
. . the importance of planning variety in lessons	58	73.4	53
My normal style of teaching is expository	31	39.24	54
My normal approach to teaching is pupil-centred	31	39.24	55
The exercise helped me improve the judgements I made of my students	47	59.49	56
- I had difficulty in assigning student styles	40	50.63	57
- the exercise helped improve the judgements I made of the students	24	30.37	58
- discovered a method of enhancing learning by considering their learning styles	30	37.97	59
- before this lesson I had not reflected on the variety of learning styles	41	51.89	60
- the lesson was difficult to teach because of the pressure of time	40	50.63	61
I fully intend to use the Kolb cycle again	44	55.69	62
A lesson like this takes too long to plan	21	26.58	63
- will use imagery sporadically in the future	47	59.49	64
- will made important adjustments to my teaching as a result of what I learnt during this exercise	28	35.44	65
- am likely to return to expository teaching because of the demands of the syllabus	23	29.11	66
- maybe I should vary my teaching styles on a roster basis	28	35.44	67
It is important for teachers to have an idea of the learning styles of their pupils	54	68.35	68
I would use a learning style inventory in the future	23	29.11	69
I would use this approach [or similar] to establish the learning styles of my pupils	37	46.83	70
Whit it is important to recognise there are a variety of learning styles in a class, students should not be labelled.	68	86.0	71

Exhibit 5. Rating scale used with the 1996 cohort of graduate student teachers.

Comment	Diverger	Assimilator	Converger	Accommodator	Unknown	N
Awareness of need to cater for different styles.	1	5	3	1	2	12
More interaction student centred study.			3	4	1	8
Less formal teaching, more facilitation.	1	5	3	1	2	12
Psychological approach.				1		1
Unspecified.		1			1	2

*Note: some students made more than one comment.

Exhibit 6. The learning styles of the graduate student teachers in the second sample where known against their reflections of the effect of the lesson on them.

An Evaluation of Kolbs

Originals of diagrams which may reproduce better than the photo-copies - except Exhibit 5 which is the original.

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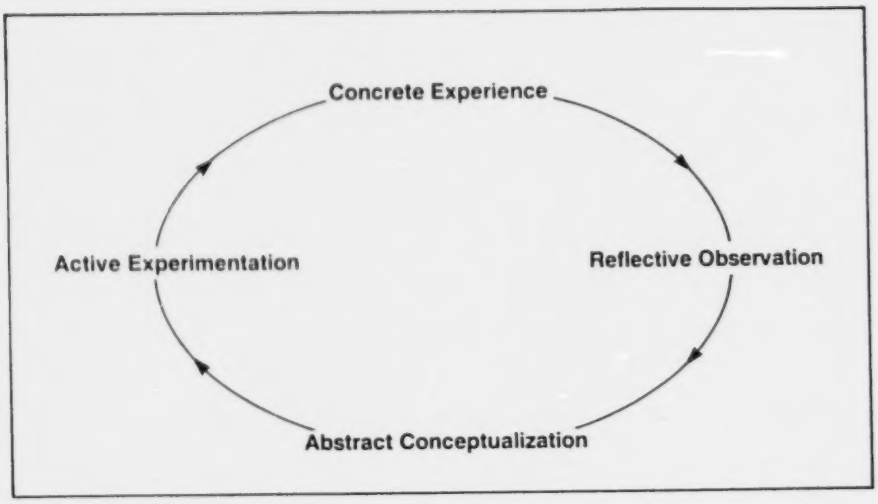

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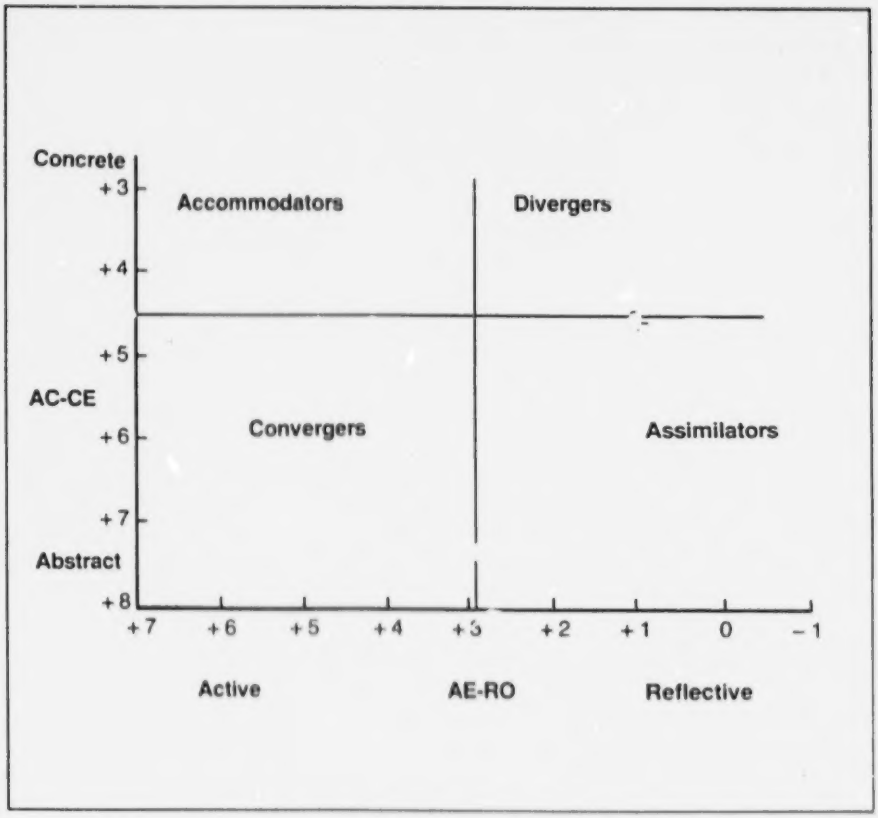

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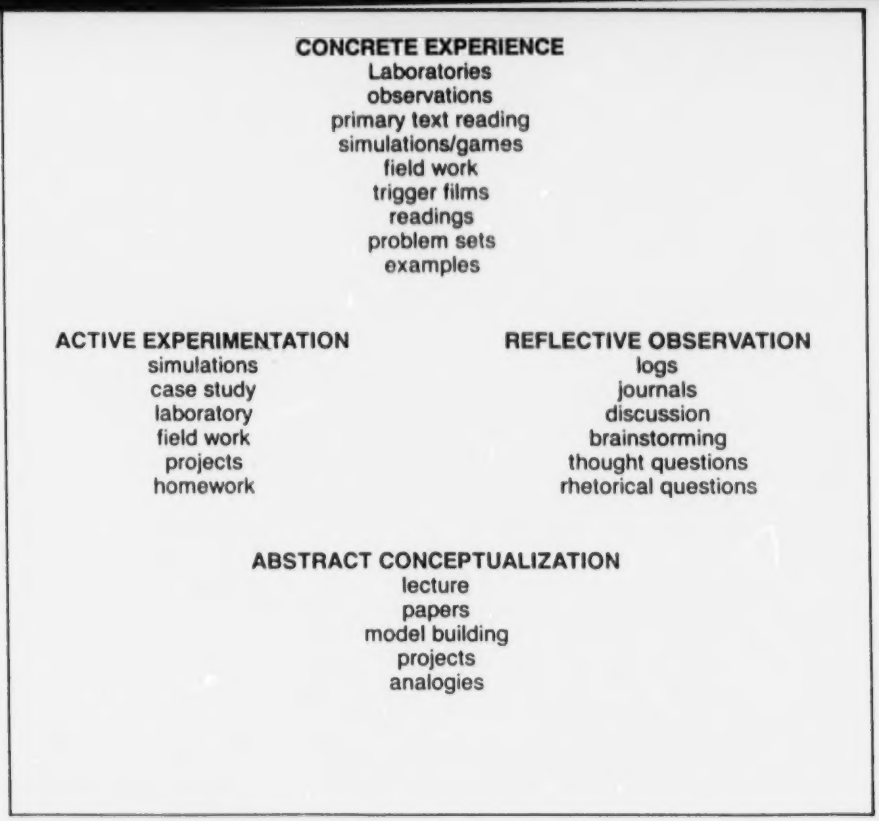

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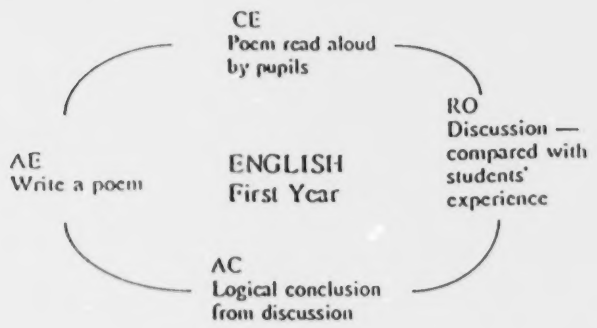
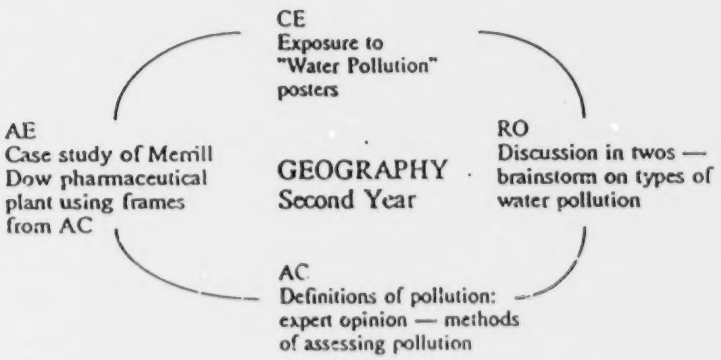
Poem appreciation



Water Pollution


CE
Exposure to "Water Pollution" posters
AE
Case study of Merrill Dow pharmaceutical plant using frames from AC
GEOGRAPHY
Second Year
RO
Discussion in twos — brainstorm on types of water pollution
AC
Definitions of pollution: expert opinion — methods of assessing pollution

Rituals of Spain

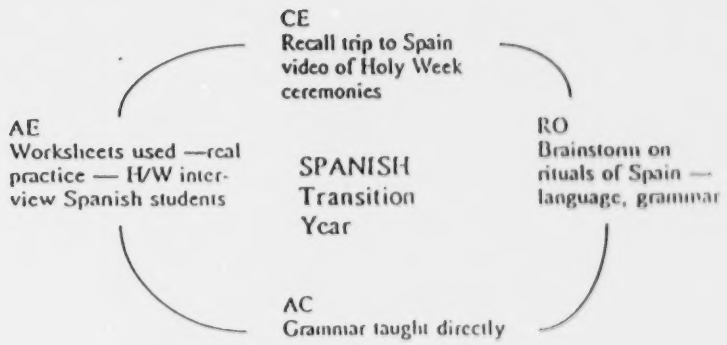
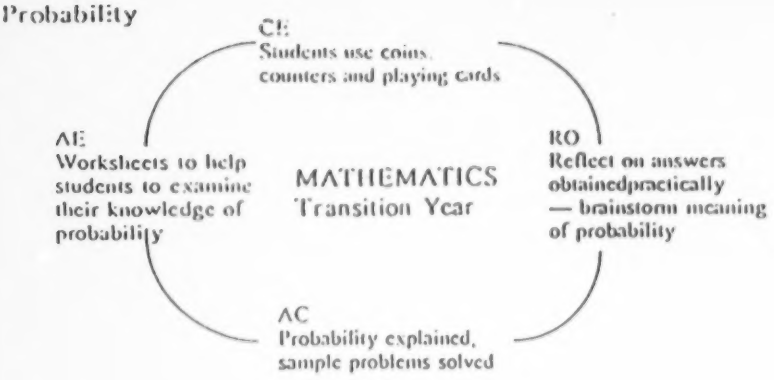
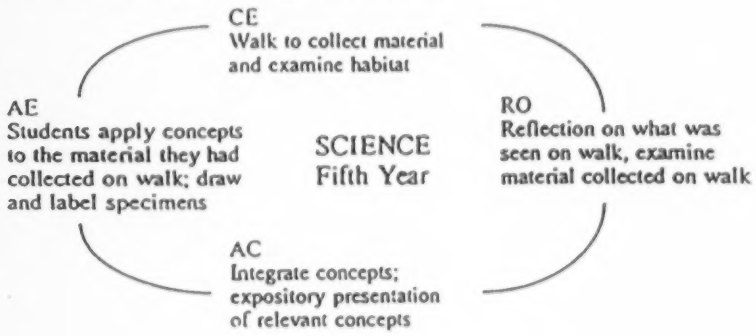


Exhibit 4. Some schematic examples of lessons given by the graduate student teachers whose work is described in the text.

Probability

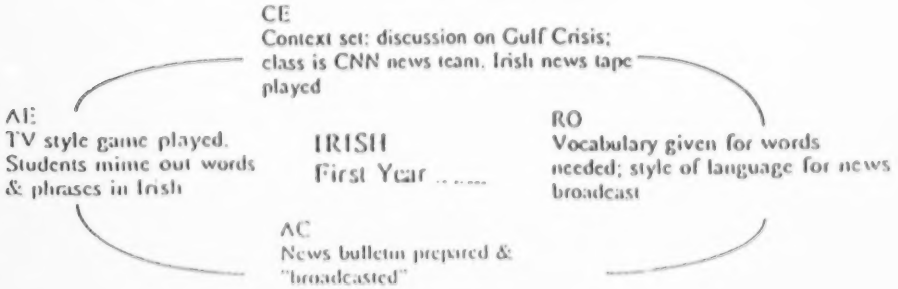


External Structure of Dicotyledonous Plant


CE
Walk to collect material and examine habitat
RO
Reflection on what was seen on walk, examine material collected on walk
AC
Integrate concepts; expository presentation of relevant concepts
AE
Students apply concepts to the material they had collected on walk; draw and label specimens
SCIENCE
Fifth Year

Warrior Culture of the Celts

Vocabulary for use in a Current Event (Gulf Crisis)


CE
Context set: discussion on Gulf Crisis; class is CNN news team. Irish news tape played
RO
Vocabulary given for words needed; style of language for news broadcast
AC
News bulletin prepared & "broadcasted"
AE
TV style game played. Students mime out words & phrases in Irish
IRISH
First Year

Comment	Diverger	Assimilator	Converger	Accommodator	Unknown	N
Awareness of need to cater for different styles.	1	5	3	1	2	12
More interaction student centred study.			3	4	1	8
Less formal teaching, more facilitation.	1	5	3	1	2	12
Psychological approach.				1		1
Unspecified.		1			1	2

*Note: some students made more than one comment.

Exhibit 6. The learning styles of the graduate student teachers in the second sample where known against their reflections of the effect of the lesson on them.